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way is in almost perfect condition to Indiana, but from there on west it is mainly a dirt road, although much better kept than the neighboring roads. Last summer it is estimated that 5,000 men were busy at one time improving this highway, and when we remember that the concept of a transcontinental highway is less than three years old, we may be well pleased at the results already accomplished.

These extended highways will do more to thoroughly knit our citizens together in the firm bonds of a mutual understanding of each other's problems than any influence now discernible.

But, as stated before, such great enterprises cannot be successfully completed without Federal aid, and it appears now probable that the national government will in the near future reembark on the great problem of road building with which it has done almost nothing for over half a century. Then, when nation, states, counties, and local communities work together, we may construct such a network of roads as will make them the pride and boast of every American citizen.

A Study of Foods for Infants.

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When we come to consider the great number of proprietary foods for infants which are rapidly flooding the markets, we cannot help but pause and study the value of these proprietary products. The reason for such a flooding of the market with these proprietary foods is evident because, first, a great many mothers are unable to nurse their children, and, second, a great many will not nurse them because of a so-styled reason of their duty to society. The first reason should have the sympathy of everyone, but the second is no reason at all and should be discouraged.

This article will not deal especially on the infant-feeding question, but will be confined to a study of foods for infants, giving such facts as will tend to discourage the use of proprietary foods. When we stop to study the composition of the largest sellers among the proprietary foods for infants we are impressed with the fact that they are comparatively useless, and in some cases harmful to children under one year of age. In fact, a study of the available statistics in this country and abroad goes to show that high infant mortality is due either to the improper feeding of cow's milk to infants up to six or nine months of age, or, in all probability, is due to the feeding of artificially prepared patent baby foods which set up a disturbance of the child's delicate digestive organs. The late Walter Wyman, of the United States Public Health Service, said that it is recognized that gastro-intestinal disease is the largest factor determining infant mortality, a condition in great measure due to improper methods of feeding, and that this enormous loss of potential wealth is of grave concern to the state and worthy of most careful consideration.

Chart I shows the relation of the nutritive ratio to the physiological fuel value of the most common proprietary foods for infants found in this country. This chart also shows this relation in comparison with

cow's milk and human milk calculated on the same dry basis as the proprietary foods. In the physiological fuel value, the results are expressed in large calories per 100 grams of the sample. The factors used were fat 9, protein 4, and carbohydrates 4, these being the physiological fuel values of food constituents. The nutritive ratio is, according to Sherman's formula:

$$\frac{\text{Carbohydrates} + 2\frac{1}{4} \times (\text{fat})}{\text{proteins}}$$

In studying this chart one cannot help but realize that the only known substitute for human milk in this country is cow's milk, especially in its physiological fuel value. Dr. Joseph W. Schereschewsky, formerly of the United States Public Health Service, says that cow's milk is the only food supply, apart from mother's milk, that is available in this country, from a practical standpoint, for the nourishment of infants under one year of age.

In a study of the analyses of these proprietary foods as listed, and as analyzed by American, Canadian and English chemists, the objection to the nonstarchy proprietary baby foods is that they are either deficient in fat or in available salts or mineral matter, or both. The objection to the others is that they contain too much starch. Stewart says that the frequent connection between rickets and deficiency in fat is an undeniable clinical fact. Doctor Schereschewsky says that the proprietary infant foods and condensed milk, which are anything but rich in fat and available mineral matter, are themselves the most prolific causes of infantile scurvy. Cantley's conclusions in regard to proprietary baby foods which contain a high per cent of starch are that, first, a diastasic ferment is secreted by the salivary glands and pancreas of new-born infants; this salivary secretion, however, is scanty in young infants and rarely appreciable before the age of two months. Second, barley water contains about 2 per cent of starch; mixtures containing this per cent of starch are not injurious, but may be beneficial for the growth of lactic acid bacilli, and the formation of lactic acid bacilli are thereby encouraged. These organisms are of undoubted advantage in the prevention of the growth of proteolytic bacteria. Third, the evil-effects of starch in early life are due to, (a) excess, (b) its administration in the form of a more or less insoluble emulsion instead of a soluble starch, (c) the substitution of starch for the necessary protein, fat and salts. From Cantley's conclusions it is self-evident that the majority of proprietary foods for infants which contain large amounts of starch, even when they are diluted for use, are harmful. From various analyses of American, English and Canadian analysts, the following contain great excesses of starch:

Starchy Baby Foods.

TABLE I.

Allensbury's Malted Food No. 3	—66.3 per cent wheat starch;
Benger's Food for Infants	—59.57 per cent wheat starch;
Chapman's Food	—greater per cent of carbohydrates are wheat starch;
Carnick's Food	—16.20 per cent wheat starch;
Eskay's Food	—28.41 per cent raw arrowroot starch;
Frame's Food	—greater per cent of carbohydrates due to wheat starch;
Fessenden's Food	—35.69 per cent arrowroot starch;
Neave's Infant Food	—greater part of carbohydrates due to wheat starch;
Nestle's Food	—35.34 per cent wheat starch;
Ridge's Food	—70.73 per cent wheat starch;
Sunbright's California Baby Food	—63.25 per cent barley starch;
Imperial Granum	—76.60 per cent wheat starch; and
Lactated Food	—41.94 per cent wheat starch.

Those foods for infants that contain no starch, but are either deficient in fat or in available mineral matter, or both, are:

Contain no Starch but Deficient in Fat or in Available Mineral Matter or Both.

TABLE II.

Horlick's Malted Milk;	Robb's Soluble Milk Food,
Meadow's Malted Milk;	(Elgin & Co.'s)
Wample's Milk Food;	and condensed and evaporated milks.

R. Hutchinson says that it is often contended for these proprietary products that they are more easily digested than natural foods and that many of them exist because they are predigested. He says that the necessity for peptonizing foods is greatly exaggerated, and that in pathological chemistry pepsin is almost never absent from the gastric juice unless hydrochloric acid is also absent. If hydrochloric acid can be found in the stomach, pepsin is sure to be there too; there is, therefore, little necessity for predigested foods.

With all these objections as pointed out, there is still an economic objection to proprietary foods for infants. Most of them contain a ridiculously small amount of nourishment at the retail price paid. Hutchinson says that it is vastly more expensive to rear a child upon one of them than upon fresh or even condensed milk. Mention might be made of the retail price calculated per pound net of some of these proprietary foods for infants. These are tabulated, and calculated in the following table:

TABLE III.

<i>Trade name of infant food.</i>	<i>Calculated price paid per lb. net.</i>
Cow's milk at 4 cents per liquid pound (calculated on dry basis)	\$0.31
Allenby's Malted Milk No. 3 . . . . .	.32
Ridge's Food . . . . .	.47
Sunbright's Baby Food . . . . .	.58
Nestle's Food . . . . .	.61
Imperial Granum . . . . .	.74
Carnick's Food . . . . .	.77
Lactated Food . . . . .	.79
Elgin's Meadow Malted Food . . . . .	.84
Fessenden's Food . . . . .	.85
Horlick's Malted Milk . . . . .	.87
Borden's Malted Milk . . . . .	.87
Wample's Food . . . . .	.90
Benger's Food . . . . .	.93
Eskay's Food . . . . .	.95
Mellin's Food	1.49

The facts in Table 3 are given as if these proprietary baby foods have the same food value in calories per pound as cow's milk. Table 4 which

follows shows that this is far from being the case. It also demonstrates the economy in buying cow's milk instead of proprietary baby foods, as far as the food value in calories per pound is concerned:

TABLE IV.

\$0.31 worth of cow's milk is equal in food value to

\$0.44	worth of Allenbury's Malted No. 3;
.66	worth of Ridge's Food;
.78	worth of Nestle's Food;
.82	worth of Sunbright's Baby Food;
1.02	worth of Imperial Granum;
1.03	worth of Horlick's Malted Milk;
1.05	worth of Carnick's Food;
1.11	worth of Lactated Food;
1.12	worth of Elgin's Meadow Malted Milk;
1.13	worth of Borden's Malted Milk;
1.20	worth of Fessenden's Food;
1.24	worth of Wampole's Food;
1.28	worth of Eskay's Food;
1.31	worth of Benger Food;
2.09	worth of Mellin's Food.

The food value in calories per pound is obtained by multiplying the sum of the per cents of carbohydrates and protein by 18.6. To this product add the product of the per cent of fat multiplied by 42.2.

Holt in "Diseases of Infancy and Childhood," p. 243, quotes the following table with reference to occurrence of infantile scurvy:

Previous Food.

Breast milk	12 cases, alone in 10
Raw cow's milk	5 cases, alone in 4
Pasteurized milk	20 cases, alone in 16
Condensed milk	60 cases, alone in 32
Sterilized milk	107 cases, alone in 68
Proprietary infant's foods	214

The translator in the preface of Pierre Budin's French book, "The Nursling," says in regard to this table quoted: "The disease (infantile scurvy) may thus arise under all forms of feeding. I do not know of any recorded case of infantile scurvy arising from sterilized milk where systematic analysis showed the milk to have been consistently of good quality. It is the poverty of the milk and not its sterilization which causes the disease. In sterilized milk alone is safety, and it must be the basis of all artificial feeding. The importance of the quality of milk which is to serve as a food for infants need hardly be emphasized. But besides the purity and quality, the amount of the infant's daily diet must be supervised. The purest of milks, the sterile supply which flows from a mother's breast, given in excess, may cause fatal digestive troubles. Each medical man ought to regulate the feeding of all infants born under his charge. His calling demands it as a duty, his humanity as a right. Every practitioner should be a center for the protection of infant life."

I mention this quotation from Professor Budin's book because in America there is a great deal of prejudice against sterilized milk, for it is thought to give rise to infantile scurvy. The two authorities in France, Budin and Dufour, have used sterilized milk in infant feeding for many years, have reared innumerable infants on it, and yet they have not had a single case of infantile scurvy. Doctor Pierre Budin towers far above

any authority in France on infant feeding. You cannot but be impressed with the mass of statistics and tables by which he gives his arguments for the use of sterilized milk. His book, "The Nursling," with its ten lectures may be profitably studied.

Dr. Walter Lester Carr, in an introduction to the American edition of Doctor Budin's book, makes a criticism as follows: "These lectures are wanting in a description of what is known in America as the percentage method for modifying milk for infants and the calculations made on the basis of the use of whole milk sterilized may be questioned as unreliable from the standpoint of scientific infant feeding. Percentage modifications have no part in this book, as can be seen at a cursory glance, but the valuable part of the work is shown in an appreciation of the mortality of young infants both in and out of the hospital due to the inability of mothers to nurse their offspring and to the ignorance of the mothers in the essentials of artificial feeding. The care of the milk, the instruction to the mothers in methods of feeding and in cleanliness and the personal oversight exercised by the physicians under Doctor Budin's direction, had much to do with the improved health of the infants whose histories are recorded; sterilized milk was not alone responsible for the improvement. Sterilized milk was for Doctor Budin's purpose better than unsterilized stale milk, but putting aside any consideration of the relative values of unsterilized and sterilized milk for infants the fact remains that Doctor Budin presents in his course of lectures details of infant feeding and management that gave him good results and are of great clinical interest to all who are working with a definite purpose towards a goal of a lessened infantile morbidity and mortality."

Doctor Budin's theory is in short that the sterilization of cow's milk lessens the difficulties with the digestion of casein and he feels sure that infants fed with sterilized milk suffer less from rickets, scurvy, and intestinal disorders than infants fed in other ways.

Dennett in "Simplified Infant Feeding" (1915) says that in prescribing food for any infant, there are three main points for consideration. First: it should contain the proper elements to maintain nutrition and to allow growth; second: it should be digestible; and third: it should contain the proper quantity of food, which is best estimated by caloric standards. Dennett states that he believes and has proven to his satisfaction that any deficiency in fat may be made up by adding sugar. In support of this he says, "How else can one explain the splendid results obtained in feeding infants throughout the bottle period with a mixture containing far less fat than breast milk? For these reasons it is not necessary to use top-milk mixtures or to add cream to milk mixtures." Dennett also states in regard to proprietary baby food as follows: "If a proprietary food has been used, one must know what that proprietary food contains, in order not to repeat the error that has already caused digestive disturbances or malnutrition." Dennett's idea of proprietary foods for infants is that many of these foods are made up of ingredients which may be very properly used in infant feeding with great benefit to the individual infant—if the physician does not object to the use of a food that is advertised to the laity. Further he says, however, that these foods should be

intelligently used and not merely according to a set of general formulas which the manufacturer prepares. In other words, he says that the physician should be equipped with a sufficient understanding of infant feeding to construct each formula to suit the needs of the individual patient. If, for instance, a food is used that is composed of malt sugar, a sufficient knowledge of infant feeding would indicate the exact amount of milk and water necessary to be added to this food.

Dennett says that since cow's milk was intended for the calf such measures of modification or dilution must be taken in order to adapt it to the human infant's digestion.

L. Emmett Holt, M. D., LL. D., professor of diseases of children in the College of Physicians and Surgeons (Columbia University), in his book on "The Care and Feeding of Children," says: "Scurvy is a disease of general nutrition, usually caused by the long continued use of improper food. Most of the cases come from the use of the prepared infant's foods sold in the stores, especially when they are given without fresh milk; occasionally the use of condensed milk and of sterilized milk is followed by scurvy; sometimes it is seen when, owing to feeble digestion, it has been necessary to make cow's milk very weak for a long time—If not recognized, or untreated, it may cause death."

In a book on nursing by Amy E. and Thirza A. Pope they say that rickets is supposed to be due to a lack of fat, proteid food, and salts in the diet. The prevention is food rich in mineral matter, as fruit juices, and, if the child is old enough, vegetables and rare or uncooked beef, milk, eggs, etc. Starches are restricted.

TABLE SHOWING AVERAGE ANALYSES, ALL SOURCES—FOODS FOR INFANTS.

NAME OF FOOD.	Per cent fat.	Per cent mineral matter or ash.	Per cent protein (Nx6.25).	Per cent carbohydrates.	Per cent water.	Remarks as to principal carbohydrates.
Allenbury's No. 3	0.87	1.01	11.47	81.66	5.31	Wheat starch, lactose, maltose and malt.
Borden's	0.83	1.07	12.00	78.49	8.61	Raw wheat starch.
Borden's Malted	6.14	3.17	13.38	71.89	5.42	Converted starch and lactose.
Carnick's	1.69	2.79	15.86	78.99	3.46	Wheat starch and milk sugar.
Chapman's	1.98	1.64	12.76	74.26	9.37	Wheat and starch.
Eskay's	1.20	1.34	6.56	87.84	3.06	About equal parts raw arrow-root, starch and milk sugar.
Frame's	0.46	1.52	13.31	81.34	3.37	Baked wheat starch, maltose, dextrose and cane sugar.
Fessenden's	0.40	1.60	6.00	86.05	5.95	About equal parts raw arrowroot, starch and dextrose.
Horlick's Malted	5.80	3.64	13.73	76.83	3.25	Dextrose, malt, lactose and active diastase.
Meadow Malted (Elgin's)	4.11	3.22	13.88	74.75	4.04	Dextrose and lactose.
Mellin's	0.55	3.49	11.43	80.33	4.20	Maltose.
Neave's	0.91	0.68	13.44	79.57	5.40	Wheat starch.
Nestle's	5.10	1.92	11.14	78.99	2.85	Dextrose and wheat starch.
Ridge's	0.95	0.70	12.21	78.79	7.35	Raw wheat starch.
Robb's	14.50	3.46	14.31	65.21	2.52	Milk sugar due to dried milk.
Sunbright's	0.70	1.09	7.94	81.75	9.00	Barley starch, small amount dextrose.
Wampole's	4.53	4.98	15.31	69.01	6.17	Milk sugar.
Imperial Granum	0.58	0.47	13.45	79.55	5.95	Wheat starch.
Condensed Milk, sweetened (dry basis)	14.33	1.76	11.38	72.53	.....	Due to original 14.92% cane sugar and 11.97% milk sugar.
Condensed Milk, unsweetened (dry basis)	28.76	5.50	30.75	34.99	.....	Due to original 9.85% milk sugar.
Cow's Milk (dry basis)	28.59	5.57	27.87	37.97	.....	Due to milk sugar and lactose.
Human Milk (dry basis)	30.02	2.46	18.18	49.34	.....	Due to milk sugar and lactose.

CONCLUSIONS.

1. When we stop to study the composition of the majority of proprietary foods for infants we are impressed with the fact that they are comparatively useless and *in some cases harmful to children under one year of age.*

2. There is no doubt but that the use of these kinds of foods for infants sets up a disturbance of the child's delicate digestive organs. First, because of an excess of starch in an insoluble emulsion. Second, the lack of available mineral salts. Third, because of the deficiency in fat, which is needed for fuel value.

3. Most investigators have agreed that cow's milk is the only food supply, apart from mother's milk, that is available in this country, from a practical standpoint, for the nourishment of infants under one year of age.

4. Eminent specialists say that there is little necessity for predigested foods.

5. From analyses by American, English and Canadian chemists, it is proven that there is no proprietary food for infants on the market that can anywhere near compare with cow's milk as a substitute for woman's milk, especially in the physiological fuel value.

6. The deficiency in fat and available mineral matter in most of these proprietary foods for infants may give rise to rickets or to infantile scurvy.

7. The economic question is at issue in that most of these proprietary foods for infants contain a ridiculously small amount of nourishment at the retail price paid.

8. The majority of claims for proprietary foods for infants are largely fallacious.

9. The heating required in the making of condensed or evaporated milk or in the making of milk powders or proprietary foods for infants which contain dried milk destroys the important enzymes which are said to have anti-scorbutic properties. In other words, *excessive heat* kills the milk enzymes naturally found in raw milk, which are said to have a tendency to prevent scurvy. This does not mean that heated or sterilized milk will cause scurvy, but scurvy may be prevented if *excessive heat* is not used.

10. Investigators have proven that even in a ten per cent solution of these proprietary foods for infants, a homogeneous mixture cannot be obtained. In some of the products which contain starch, this is due to a formation of a pasty or emulsified condition due to the swelling of the starch grains.

11. Proprietary infant foods should never be used except on a physician's advice. Such products are not for the laity to use according to manufacturer's formula. They are as bad a menace to the public as so-called patent medicines. One should know what is needed for the child before feeding a food that has no advantage over good cow's milk.

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